PATENT ABSTRACTS OF JAPAN

(11)Publication number : **11-112417**

(43)Date of publication of application : **23.04.1999**

(51)Int.Cl. H04B 7/26
H04J 13/00

(21)Application number : **09-275368**

(22)Date of filing : **08.10.1997**

(71)Applicant : **OKI ELECTRIC IND CO LTD**

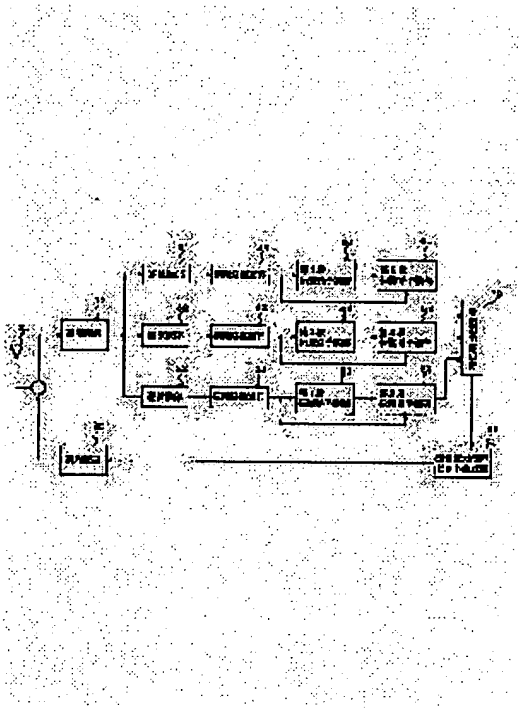
(72)Inventor : **SHIRAKI YUICHI**
YAMANO CHIHARU

(54) TRANSMISSION POWER CONTROL METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a transmission power control method in which deviation of power from desired power for transmission power control is reduced due to a control delay when a mobile station moves faster.

SOLUTION: Propagation path estimate sections 41-43 of a base station estimate a complex envelope produced in a radio propagation channel through which a transmission signal sent from a mobile station propagates, 1st stage propagation path predict sections 51-53 predict the complex envelope at a current point of time with respect to the mobile station based on the complex envelope estimate value, 2nd stage propagation path predict sections 61-63 predict a future complex envelope with respect to the mobile station based on the complex envelope predicted value and the complex envelope estimated value at a current point of time, a reception power calculation section 70 calculates future reception power with respect to the mobile station based on the future complex envelope predicted value, a transmission power control bit generating section 80 generates a transmission power control instruction signal based on the received power. The base station sends the transmission power control instruction signal together with a transmission signal.



LEGAL STATUS

[Date of request for examination]	09.02.2001
[Date of sending the examiner's decision of rejection]	19.11.2002
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the transmitted power control approach in a radio communications system which communicates between at least one base station and two or more mobile stations in a base station It is based on the sending signal to which the known sign was inserted in at intervals of predetermined, and was transmitted from the mobile station. Presume the complex envelopment produced in the wireless propagation path which the sending signal wears, and it is based on the presumed complex envelopment estimate. Predict the value of the complex envelopment at present to said mobile station, and it is based on the predicted complex envelopment forecast at present and said complex envelopment estimate. Predict the value of the future complex envelopment to said mobile station, and based on the predicted future complex envelopment forecast, compute the future received power to said mobile station, and a transmitted power control-lead signal is generated based on the computed received power. The transmitted power control approach characterized by controlling the transmitted power of a signal based on the transmitted power control-lead signal which transmitted the transmitted power control-lead signal with the sending signal, and was transmitted from said base station in the mobile station.
[Claim 2] In the transmitted power control approach in a radio communications system which communicates between at least one base station and two or more mobile stations in a base station Presume the complex envelopment produced from a mobile station in the wireless propagation path which the sending signal wears based on the sending signal to which the known sign was inserted in at intervals of predetermined, and was transmitted, and linear predictive coding of the time series value of the past of the presumed complex envelopment estimate is carried out. Predict the value of the complex envelopment at present to said mobile station, and it is based on the predicted complex envelopment forecast at present and said complex envelopment estimate. Predict the value of the future complex envelopment to said mobile station, and it is based on the predicted complex envelopment forecast. Based on the predicted complex envelopment forecast, compute the future received power to said mobile station, and a transmitted power control-lead signal is generated based on the computed received power. The transmitted power control approach characterized by controlling the transmitted power of a signal based on the transmitted power control-lead signal which transmitted the transmitted power control-lead signal with the sending signal, and was transmitted from said base station in the mobile station.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the transmitted power control approach in a radio communications system which communicates between at least one base station and two or more mobile stations in a base station It is based on the sending signal to which the known sign was inserted in at intervals of predetermined, and was transmitted from the mobile station. Presume the complex envelopment produced in the wireless propagation path which the sending signal wears, and it is based on the presumed complex envelopment estimate. Predict the value of the complex envelopment at present to said mobile station, and it is based on the predicted complex envelopment forecast at present and said complex envelopment estimate. Predict the value of the future complex envelopment to said mobile station, and based on the predicted future complex envelopment forecast, compute the future received power to said mobile station, and a transmitted power control-lead signal is generated based on the computed received power. The transmitted power control approach characterized by controlling the transmitted power of a signal based on the transmitted power control-lead signal which transmitted the transmitted power control-lead signal with the sending signal, and was transmitted from said base station in the mobile station.
[Claim 2] In the transmitted power control approach in a radio communications system which communicates between at least one base station and two or more mobile stations in a base station Presume the complex envelopment produced from a mobile station in the wireless propagation path which the sending signal wears based on the sending signal to which the known sign was inserted in at intervals of predetermined, and was transmitted, and linear predictive coding of the time series value of the past of the presumed complex envelopment estimate is carried out. Predict the value of the complex envelopment at present to said mobile station, and it is based on the predicted complex envelopment forecast at present and said complex envelopment estimate. Predict the value of the future complex envelopment to said mobile station, and it is based on the predicted complex envelopment forecast. Based on the predicted complex envelopment forecast, compute the future received power to said mobile station, and a transmitted power control-lead signal is generated based on the computed received power. The transmitted power control approach characterized by controlling the transmitted power of a signal based on the transmitted power control-lead signal which transmitted the transmitted power control-lead signal with the sending signal, and was transmitted from said base station in the mobile station.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the transmitted power control approach in a mobile radio communication link, especially a sign division multiplex communication system (henceforth CDMA).
[0002]
[Description of the Prior Art] Conventionally, there were [Andrew J.Viterbi, "CDMA Principles of Spread Spectrum Communication", Addison Wesley Publishing Company] as reference about this kind of CDMA. In such CDMA, each mobile station shares and uses the same frequency band, instead the sending signal from each mobile station is identified by the diffusion sign assigned to each mobile station at the proper.
[0003] Drawing 2 is an explanatory view for explaining the conventional transmitted power control approach, and shows the configuration by the side of a base station. They are the radio-frequency head which 10 changes the input signal from a mobile station into a transceiver antenna, and changes 11 into the signal of a diffusion band in drawing, the RAKE receive section where 12 decodes the output signal of a radio-frequency head 11 as baseband signaling, the received-power calculation section in which 13 computes received power, the transmitted power control-bit generation section which generate the bit by which 14 controls transmitted power, and the radio-frequency head which 15 makes the message channel signal with which the transmitted power control bit was inserted a wireless band signal, and discharge with a transceiver antenna 10.
[0004] Here, although the received power in the base station from a mobile station needs to be the same in order for the speech quality of each mobile station to be the same and fair, the power of the input signal from each mobile station is accompanied by the fluctuation (phasing) accompanying migration. So, in the conventional example shown in drawing 2 , the excess and deficiency of received power are notified from a base station, and the mobile station is adjusting transmitted power according to the directions. In addition, although such control is called transmitted power control by the closed loop, transmitted power control also uses together the open loop control which controls power automatically, without a mobile station receiving directions of a base station.
[0005] Next, actuation of the conventional example is explained. First, in a base station, the back diffusion of electrons is carried out to the mobile station having used the signal received through the radio-frequency head 11 in the RAKE receive section 12 with the same diffusion sign, this actuation is performed according to the amount of delay of a delay wave, and each delay wave is added and is compounded. In the received-power calculation section 13, it is and fixed section (Tpc [sec]) observation of the power of this composite signal is carried out. And by the transmitted power control-bit generation section 14 If the mean power of the section is large compared with a desired value, only a certain fixed rate will lower the transmitted power of a mobile station. Get down with the period of the fixed section (Tpc [sec]), and the 1-bit directions information (transmitted power control bit) that only a certain fixed rate will raise the transmitted power of a mobile station if small compared with a desired

value is inserted in the message channel of a circuit (communication link to a mobile station from a base station). It notifies to a mobile station as a radio signal through a radio-frequency head 15.
[0006] And a mobile station takes out this transmitted power control bit for every fixed period out of a recovery signal, if the contents of the transmitted power control bit are directions of transmitted power raising, only a fixed rate will raise transmitted power, and if the contents of the transmitted power control bit are directions of transmitted power lowering, the signal which transmitted by performing transmitted power control only whose fixed rate lowers transmitted power can receive with desired power in a base station.
[0007]
[Problem(s) to be Solved by the Invention] the next observation section of the received-power observation section which used by the transmitted power control bit for it carrying out generation transmission in directions that the effect of transmitted power change with a mobile station is reflected in the received power in a base station even if a mobile station carries out transmitted power change according to these directions, since control lead of transmitted power is taken out after a base station carried out the fixed section observation of the received power of the signal from a mobile station by the above conventional transmitted power control approaches -- receiving -- ** -- it will become. For this reason, when migration of a mobile station was slow and time amount change of the received power by phasing was moderate, there was little effect of this control delay, but when migration of a mobile station was quick and time amount change of the received power by phasing was sudden, there was a trouble that the effect of this control delay will become large, and will increase the gap from the request power of transmitted power control.
[0008]
[Means for Solving the Problem] In the transmitted power control approach in a radio communications system that the transmitted power control approach concerning this invention communicates between at least one base station and two or more mobile stations in a base station It is based on the sending signal to which the known sign was inserted in at intervals of predetermined, and was transmitted from the mobile station. Presume the complex envelopment produced in the wireless propagation path which the sending signal wears, and it is based on the presumed complex envelopment estimate. Predict the value of the complex envelopment at present to a mobile station, and it is based on the complex envelopment forecast at present and the complex envelopment estimate which were predicted. Predict the value of the future complex envelopment to a mobile station, and based on the predicted future complex envelopment forecast, compute the future received power to a mobile station, and a transmitted power control-lead signal is generated based on the computed received power. The transmitted power control-lead signal is transmitted with a sending signal, and the transmitted power of a signal is controlled by the mobile station based on the transmitted power control-lead signal transmitted from the base station.
[0009]
[Embodiment of the Invention] Drawing 1 is an explanatory view for explaining the transmitted power control approach concerning the gestalt of 1 operation of this invention, and shows the configuration by the side of a base station. The radio-frequency head which 21 changes the input signal from a mobile station into a transceiver antenna, and changes 22 into the signal of a diffusion band in drawing, The back-diffusion-of-electrons section in which 31-33 decode the output signal of a radio-frequency head 22 as baseband signaling, The baseband signaling with which 41-43 were outputted from the back-diffusion-of-electrons sections 31-33 is inputted. The propagation path presumption section which presumes amplitude change which each delay wave receives by the wireless propagation path, and a phase change, The propagation path estimate 51-53 were presumed to be in the propagation path presumption sections 41-43 is inputted. The complex envelopment predicted in the 1st step propagation path prediction section which predicts complex envelopment of the following control period, the propagation path estimate 61-63 were presumed to be in the propagation path presumption sections 41-43, and the 1st step propagation path prediction sections 51-53 is inputted. The 2nd step propagation path prediction section which predicts average complex envelopment of the following control period, the received-power calculation section in which 70 computes a received-power forecast using the average

complex envelopment to which it is outputted, respectively from the 2nd step propagation path prediction sections 61-63, 80 is the transmitted power control-bit generation section which generates the bit which controls the transmitted power of a mobile station based on the received-power forecast outputted from the received-power calculation section 70, and transmits towards a mobile station through a radio-frequency head 90 as a radio signal.

[0010] Next, actuation of the gestalt of this operation is explained. First, the input signal received with the transceiver antenna 21 is changed into the signal of a diffusion band through a radio-frequency head 22, and is decoded as baseband signaling in the back-diffusion-of-electrons sections 31-33. Here, it is d (i, k) about the decode output from the back-diffusion-of-electrons sections 31-33. It carries out. In addition, i expresses the i-th decode signal and k expresses the k-th back-diffusion-of-electrons section. And the back-diffusion-of-electrons sections 31-33 have the function which delays and carries out the back diffusion of electrons of the diffusion sign by the delay according to the delay which two or more delay waves produced in a propagation path have, and the gestalt of this operation shows the case where there are three delay waves (2 k= 1, 3).

[0011] And in the propagation path presumption sections 41-43, each delay wave inputted from the back-diffusion-of-electrons sections 31-33 presumes amplitude change and the phase change which are received by the wireless propagation path. the gestalt of this operation -- beforehand -- laws -- a sign (for example, henceforth [it is a sign showing 1 etc. and] a known sign) -- the case where it is inserted in the sending signal transmitted from a mobile station side is assumed. Here, insertion spacing of a known sign is set to Tslot, and suppose that it is inserted in the beginning in this spacing. moreover, transmitting code length -- Td ** -- it carries out, and considers as Tslot=M-Td, and m in M individual in insertion spacing of the beginning in spacing consider as the signal of a known sign. And let a current transmitted power control period be the 0th control period. First, the average a of m complex envelopment of the beginning in this control period (0 k) It computes by the degree type.

[0012]

[Equation 1]

$$a(0,k)=\sum_{i=1}^{m} d(i,k)$$

[0013] Supposing the same value is acquired to the following control period, it is the 0th average complex envelopment A (0 k). It receives and approximation like a degree type can be considered.

[0014]

[Equation 2]

A(0,k) =(1/2){a(0,k) +a(1,k) }

[0015] However, it is actually this a (1 k). Calculation will bring about control delay. So, at the 1st step propagation path prediction sections 51-53, it is a (0 k). Since the same processing as calculation can carry out an old control period, it is the complex envelopment a in the control period of these past (i, k). It uses and is a (1 k). It predicts (the forecast is made into a' (1 k)). The technique based on linear predictive coding is used for this prediction. It analyzes what kind of relation [the data with which the past data adjoin, and] linear prediction had, and a future value applies the relation. The calculation is shown in a degree type.

[0016]

[Equation 3]

$$a'(1,k)=\sum_{j=1}^{p} w(j,k)\cdot a(1-j,k)$$

[0017] P is a prediction degree and w (j, k). It is a prediction coefficient. Calculation of a prediction coefficient is Pe. It considers as a prediction error and asks from a degree type.

[0018]

[Equation 4] W=R-1 and E -- here -- W= (1, w (1 k), and w (2 k), --, w (p, k)), E= (Pe, 0, 0, --0), and R -

- a matrix -- it is -- value r of the m line n train (m, n) It is computed by the degree type (* shows a complex conjugate).
[0019]
[Equation 5]

$$r(m,n) = \sum_{i=0}^{L-1} a(-i+m,k) \cdot a(-i+n,k)^*$$

[0020] L is a (i, k) used for analysis here. It is a number. Moreover, the solution of the formula of the above [a-four number] is efficiently computable by the approaches (Levinson-Darvin law, the maximum entropy method, etc.) already learned.
[0021] If a' (1 k) is called for as mentioned above, it is the 0th average complex envelopment A (0 k). It becomes computable by the degree type.
[0022]
[Equation 6]
A(0,k) =(1/2){a(0,k) +a'(1,k)}
[0023] Furthermore, average complex envelopment A of the following control period present in the 2nd step propagation path prediction sections 61-63 (1 k) It computes by the bottom type.
[0024]
[Equation 7]
A(1,k) =(1/2){a'(1,k)+a'(2,k)}
[0025] Here, about a' (2 k), it computes by the bottom type using the prediction coefficient used in the propagation path [degree] prediction sections 51-53 the 1st step.
[0026]
[Equation 8]

$$a'(2,k) = w(1) \cdot a'(1,k) + \sum_{j=2}^{P} w(j,k) \cdot a(2-j,k)$$

[0027] And at the received-power calculation section 70, it is A (1 k). It uses and is received-power [of the following control period] p (1). It computes by the degree type.
[0028]
[Equation 9]

$$p(1) = \sum_{k=1}^{3} A(1,k) \cdot A(1,k)^*$$

[0029] and in the transmitted power control-bit generation section 80 Received-power forecast [of the following period computed in the received-power calculation section 70] p (1) If it becomes beyond a predetermined request value The transmitted power control bit as directions with which only a certain fixed rate lowers transmitted power is generated, and it is received-power forecast p (1) conversely. If smaller than a predetermined request value The transmitted power control bit as directions with which only a certain fixed rate raises transmitted power is generated, this transmitted power control bit is inserted in a message data channel for every control period, and it transmits to a mobile station from the transceiver antenna 21 through a radio-frequency head 90.
[0030] Since it was made to compute without being made to control by the gestalt of this operation by predicting the received power of the following control period from the hysteresis of the past received power in case transmitted power control is directed from a base station to a mobile station, and bringing about the delay for that prediction There is no delay by calculation of prediction, even when the passing speed of a mobile station is high, the gap from the request power of transmitted power control can be made small, and it becomes possible to offer a fairer speech quality to many users.
[0031]

[Effect of the Invention] According to this invention, it is based on the sending signal to which the known sign was inserted in at intervals of predetermined, and was transmitted from the mobile station in the base station as mentioned above. Presume the complex envelopment produced in the wireless propagation path which the sending signal wears, and it is based on the presumed complex envelopment estimate. Predict the value of the complex envelopment at present to a mobile station, and it is based on the complex envelopment forecast at present and the complex envelopment estimate which were predicted. Predict the value of the future complex envelopment to a mobile station, and based on the predicted future complex envelopment forecast, compute the future received power to a mobile station, and a transmitted power control-lead signal is generated based on the computed received power. The transmitted power control-lead signal is transmitted with a sending signal. In a mobile station Since the transmitted power of a signal was controlled based on the transmitted transmitted power control-lead signal from the base station Even when the passing speed of a mobile station is high, the gap from the request power of transmitted power control can be made small, and it becomes possible to offer a fairer speech quality to many users.

[Translation done.]

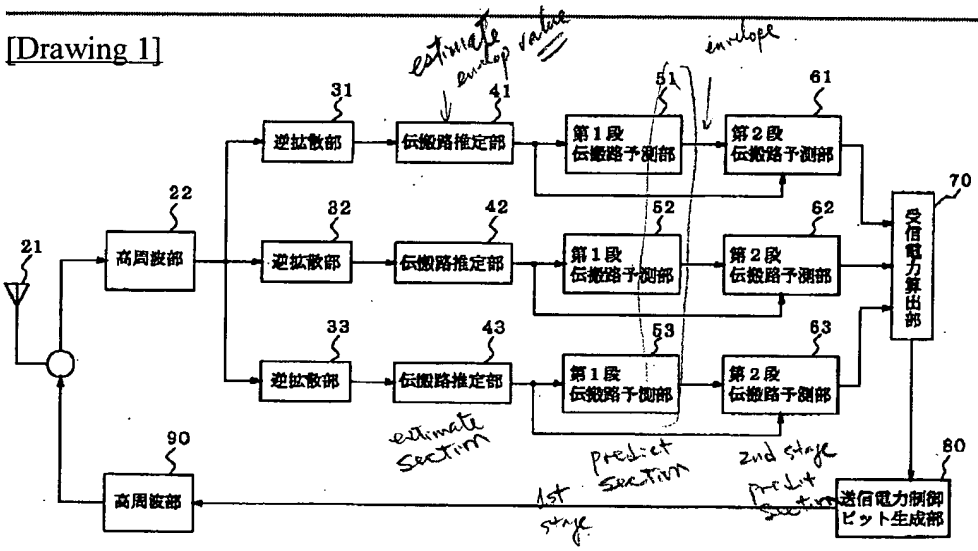
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is an explanatory view for explaining the transmitted power control approach concerning the gestalt of 1 operation of this invention.
[Drawing 2] It is an explanatory view for explaining the conventional transmitted power control approach.
[Description of Notations]
10 Transceiver Antenna
11 Radio-frequency Head (Reception)
12 RAKE Receive Section
13 Received-Power Calculation Section
14 Transmitted Power Control-Bit Generation Section
15 Radio-frequency Head (Transmission)
21 Transceiver Antenna
22 Radio-frequency Head (Reception)
31-33 Back-diffusion-of-electrons section
41-43 Propagation path presumption section
51-53 The 1st step propagation path prediction section
61-63 The 2nd step propagation path prediction section
70 Received-Power Calculation Section
80 Transmitted Power Control-Bit Generation Section
90 Radio-frequency Head (Transmission)

[Translation done.]

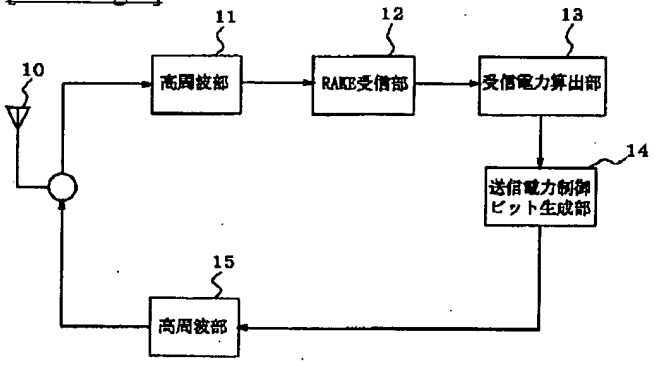
DRAWINGS

[Drawing 1]



本発明の一実施の形態に係る送信電力制御方法を説明するための説明図

[Drawing 2]



従来の送信電力制御方法を説明するための説明図

[Translation done.]